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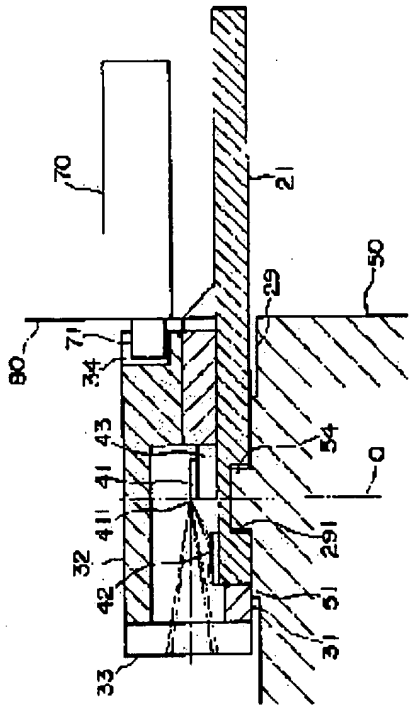
(54) LASER MODULE

(57)Abstract:

PROBLEM TO BE SOLVED: To accurately monitor quantity of light emitted from a laser diode chip.

SOLUTION: In a laser module, having a laser diode chip 41 loaded inside packages 31 and 32, a front monitor 42 is set inside the packages 31 and 32 and in front of the laser diode chip 41 for monitoring a part of the light emitted from the laser diode chip 41. The front monitor 42 is arranged outside the optical effective range of the emitted light.



LEGAL STATUS

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[Kind of final disposal of application other than

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the laser module with which not only read in but writing was suitable for possible optical recording media like CD-R, CD-RW, DVD-RAM, or MO especially about the laser module used for an optical pickup.
[0002]
[Description of the Prior Art] As everyone knows, although various peripheral devices are connected to electronic equipment, such as a personal computer, storage (record medium) is in one of them. And there are various classes also in storage (record medium), and CD-R (compact disc recordable) is in one of them. CD-R is the record medium which can be added and is compatible with CD-ROM or Audio CD (CD-DA). Although the equipment and the application for writing of dedication are required for the writing to CD-R, read-out from CD-R is made with the usual CD-ROM drive. Although the once written-in data are not eliminable, a postscript can be added repeatedly.
[0003] Moreover, CD-RW, DVD-RAM, and the magneto-optic disk (MO) are known as a kind of the optical disk in which elimination and re-writing are possible. CD-RW and DVD-RAM write in information (data) by the phase change record approach. MO is the optical memory of the shape of a disk which writes in information (data) using the heat-magnetic effect of a magnetic thin film, and reads information (data) using optical-magnetic effect.
[0004] Now, in order to write information (data) in optical disks, such as such a CD-R and MO, and to read information (data), the optical pickup for record playback for irradiating a laser beam is needed on an optical disk.
[0005] Generally, this kind of optical pickup is equipped with the laser light source which carries out outgoing radiation of the laser beam, and the optical system which leads this laser beam by which outgoing radiation was carried out to record media, such as an optical disk. Although not only informational read-out but informational writing can be performed in CD-R, CD-RW, and DVD-RAM and MO as mentioned above, it is necessary to change the output of a laser beam by which outgoing radiation is carried out from a laser light source in the time of informational read-out and informational writing by the optical pickup for CD-R, CD-RW, DVD-RAM, or MO. The reason is that it performs informational writing by forming a pit in the recording layer of an optical disk by the exposure of a laser beam, and the output of a laser beam by which outgoing radiation is carried out from the laser light source at the time of information writing is large as compared with the output at the time of information read-out, for example, is about 10 to 20 times.
[0006] Next, with reference to drawing 5 , the optical pickup used for optical disk record / regenerative apparatus, such as CD-R, is explained.
[0007] The optical pickup 1 of illustration is equipped with the actuator base 5 grade which holds the optical base 2, the lens holder 3 equipped with the objective lens 3-1, the tracking coil (not shown), and the focusing coil (not shown), the damper base 4, and a lens holder 3 and the damper base 4.
[0008] The optical pickup 1 is equipped with the laser section 11 which is the laser light source which

carries out outgoing radiation of the laser beam. The laser beam by which outgoing radiation was carried out from the laser section 11 passes along a diffraction grating (it mentions later), a beam splitter (it mentions later), a collimator lens (it mentions later), and an objective lens 3-1, and is irradiated on the optical disk (CD-R, CD-RW, DVD-RAM and MO) (it mentions later) which is an optical storage. Incidence is carried out for the photodiode (PD) which is light-receiving equipment, and (mentioning later) the reflected light from this optical disk through an objective lens 3-1, a collimator lens, and a beam splitter. That is, a photodiode receives the reflected light from an optical disk.

[0009] Optics, such as the laser section 11 and a beam splitter, are held at the optical base 2. In addition, the optical base 2 is held still more possible [sliding of the case (not shown) of an optical disk drive]. The circuit board 15 is being fixed to the side face of the optical base 2. The circuit board 15 is electrically connected to other circuit elements (not shown) of an optical disk drive by the flexible cable 16 connected to it.

[0010] Between a lens holder 3 and the damper base 4, it is connected by two or more suspension wires 6, and these assemblies are held in the actuator base 5. Some actuator bases 5 serve as York 7, and the magnet is combined with this York 7.

[0011] The actuator base 5 has the acceptance section (not shown) of the damper base 4 in the end side of the approximately frame-like object fabricated with the metallic material. In this acceptance section, it has the support block 5-1 for fixing the damper base 4. The support block 5-1 is fabricated by the actuator base 5 at one. Furthermore, the projection 5-2 of the shape of an abbreviation hemicycle supported with the supporter 2-1 formed in the optical base 2 is formed in the both-sides wall of an approximately frame-like object.

[0012] The damper base covering 4-2 formed for the transparent resin material is attached in the damper base 4, the fixed part 4-1 for fixing the end of a suspension wire 6 to the posterior part is formed, and the sound deadener (not shown) for controlling vibration of a suspension wire 6 to the space between the damper base 4 and the damper base covering 4-2 is poured in.

[0013] The flexible wiring substrate 8 for [which makes soldering connection with the edge of the previous suspension wire 6 further] having been fixed is formed in the posterior wall of stomach of the damper base 4. The damper base 4 is fixed in the condition of having been inserted in the tooth space between the both-sides wall of the actuator base 5, and the support block 5-1.

[0014] As the damper base 4 is attached across the support block 5-1 and the damper base 4 with a screw 9, it is attached, and it makes the screw 9 rotatable as a core for the damper base 4. This is for carrying out skew adjustment.

[0015] Before fixing the damper base 4 to the actuator base 5, a suspension wire 6 is attached in the damper base 4. That is, a lens holder 3 and the damper base 4 are held and fixed to the actuator base 5 in the state of the assembly connected by two or more suspension wires 6.

[0016] The example of a system configuration of the optical system of the optical pickup 1 mentioned above to drawing 6 is shown. The optical system of illustration has a laser diode LD (equivalent to the laser section 11 of drawing 3), a diffraction grating GRT, polarization beam splitter PBS, a collimator lens CL, the quarter-wave length plate QWP, the starting mirror MIR, objective lens OL (equivalent to the objective lens 3-1 of drawing 3), optical disk DISC, the sensor lens SL, and Photodiode (photo detector) PD.

[0017] It separates into three laser beams by the diffraction grating GRT, and one laser beam by which outgoing radiation was carried out rightward [level] from the laser diode LD passes polarization beam splitter PBS, a collimator lens CL, and the quarter-wave length plate QWP, is bent by the right angle by the starting mirror MIR, progresses to vertical above, and is irradiated on optical disk DISC through objective lens OL.

[0018] In addition, one central laser beam is used for signal reading among three laser beams separated by the diffraction grating GRT, and remaining two laser beams are used for a tracking servo.

[0019] The reflected light from optical disk DISC passes objective lens OL, it is bent by the right angle by the starting mirror MIR, it progresses leftward [level], passes along the quarter-wave length plate QWP and a collimator lens CL, is bent by the right angle by polarization beam splitter PBS, progresses

[it progresses to vertical down,] to water open hand front, and is received with Photodiode PD through the sensor lens SL.

[0020] By the way, the laser diode used as a laser light source is offered as a laser module which contained or carried the laser diode chip. And the photodiode chip (photo detector) for carrying out the monitor of the quantity of light which carried out outgoing radiation from the laser diode chip to this laser module is also carried. Usually, this photodiode chip is carried as a back monitor which carries out the monitor of the light (light outside an optical scope) by which outgoing radiation was carried out from the tooth-back side of a laser diode chip. This back monitor is used in order to control the quantity of light of the laser beam by which outgoing radiation is carried out from a laser diode chip.

[0021] Generally, this kind of laser module attaches a block (die) perpendicularly on the stem which consists of copper or iron, and is having structure which carried the laser diode chip through submounting on this die. Furthermore, the photodiode chip (back monitor) for carrying out the monitor of the quantity of light which carried out outgoing radiation to the tooth-back side of a laser diode chip from the tooth back of a laser diode chip is carried. And these dies, submounting, the laser diode chip, and the back monitor are covered with a cap.

[0022] However, since package cost becomes high or the directions of wirebonding of a laser diode chip and a photodiode chip differ, such a laser module of a configuration has many faults, like an assembly takes time and effort.

[0023] Then, in order to cancel such a fault, development of the leadframe type laser module as [shown in drawing 7 thru/or drawing 10] is furthered. However, the laser module of illustration is used for the optical pickup of low-power output like CD-ROM.

[0024] A bottom view and drawing 10 of the top view in the condition that drawing 7 excluded the upper package (it mentions later), the front view in the condition that drawing 8 was carried on case 50', and drawing 9 are sectional side elevations.

[0025] The laser module of illustration has leadframe 20' and body of laser module 30', and is carrying out the symmetrical configuration substantially bordering on the center line C prolonged in a cross direction. Body of laser module 30' has bottom package 31', upper package 32', and cover glass 33. Bottom package 31' and upper package 32' are put together, and it is only called a package. Since a laser module really casts leadframe 20' and a package and is manufactured, it has the advantage of being easy to manufacture.

[0026] Leadframe 20' presses the conductive plate of predetermined thickness, and is made by the configuration as shown in drawing 7 . Chip loading lead terminal 21' in which leadframe 20' of illustration carries the laser diode chip 41 and back monitor (photodiode chip) 42', Laser diode anode side lead terminal 22' and back monitor cathode side lead terminal 23', body of laser module 30' -- a case 50 -- it is connected in 'the bridge formation part 26 which has right frame supporter 24' and left frame supporter 25' which were projected outside from the both-sides side of body of laser module 30' in order to attach upwards, and these show with a two-dot chain line'. The laser diode chip 41 is carried on chip loading lead terminal 21' through the submounting 43. In addition, the diver cut of this bridge formation partial 26' is carried out by the last production process.

[0027] Chip loading lead terminal 21' has extended from the tooth-back side of body of laser module 30' in the direction of a center line C. Moreover, right-hand side and on the left-hand side of chip loading lead terminal 21', laser diode anode side lead terminal 22' and back monitor cathode side lead terminal 23' vacated spacing in parallel with chip loading lead terminal 21', and have extended, respectively.

[0028] a laser diode -- a chip -- 41 -- the back -- a monitor -- 42 -- ' -- and -- sub -- mounting -- 43 -- the bottom -- a package -- 31 -- ' -- the upper -- a package -- 32 -- ' -- and -- cover glass -- 33 -- surrounding -- having had -- laser -- a module -- a body -- 30 -- ' -- hold -- space -- inside -- holding -- having . the laser diode chip 41 and the submounting 43 are carried in the tip side on chip loading lead terminal 21' (front) so that clearly from drawing 7 and drawing 10 -- having -- back monitor 42' -- the tooth-back side of the laser diode chip 41 -- chip loading lead terminal 21' -- it is carried upwards.

[0029] Notching section 241' is formed in the tooth-back side at right frame supporter 24', and notching section 251' is formed in left frame supporter 25' at the front-face side.

[0030] Next, the manufacture approach of such a laser module is explained. First, mold molding of leadframe 20' is carried out by bottom package 31'. Then, as shown in drawing 7 , wirebonding of the laser diode chip 41 and laser die OIDO anode side lead terminal 22' is carried out with the 1st wire 61, and wirebonding of back monitor (photodiode chip) 42' and back monitor cathode side lead terminal 23' is carried out with the 2nd wire 62. And bottom package 31' and upper package 32' are joined to a front face by adhesives or ultrasonic welding in the condition of having arranged cover glass 33. And the diver cut of above-mentioned bridge formation partial 26' is carried out.

[0031] such a laser module of a configuration is shown in drawing 8 and drawing 10 -- as -- crevice 51' of the rectangle of case 50' -- it is arranged upwards. As mentioned above, as shown in drawing 7 and drawing 9 , notching section 241' and 251' are prepared in right frame supporter 24' and left frame supporter 25', respectively. moreover, case 50' -- upwards, right boss 52' and left boss 53' have projected in the location of right and left close to crevice 51', respectively. laser -- a module -- a case -- 50 -- ' -- a crevice -- 51 -- ' -- a top -- carrying -- the time -- drawing 7 -- and -- drawing 9 -- being shown -- having -- as -- the right -- a boss -- 52 -- ' -- and -- the left -- a boss -- 53 -- ' -- respectively -- the right -- a frame -- a supporter -- 24 -- ' -- notching -- the section -- 241 -- ' -- and -- the left -- a frame -- a supporter -- 25 -- ' -- notching -- the section -- 251 -- ' -- being engaged -- making -- this -- a laser module -- positioning . then, the UV adhesives 55 -- the parts of right boss 52' and left boss 53' -- from a top -- dripping -- a laser module -- case 50' -- it fixes upwards. You may weld with solder etc. instead of the UV adhesives 55.

[0032] Since leadframe 20' and bottom package 31' are really cast in the case of such a leadframe type laser module of a configuration, there is an advantage of being easy to manufacture. Moreover, since the laser diode chip 41 and back monitor 42' can be arranged on the same flat surface, there is also an advantage that wirebonding is easy.

[0033]

[Problem(s) to be Solved by the Invention] As mentioned above, in order to perform power control of the outgoing radiation light from the laser diode chip 41, by the laser module conventional leadframe type, the monitor of the quantity of light of outgoing radiation light is carried out by back monitor 42' installed in the tooth-back side of the laser diode chip 41.

[0034] The tooth back of the laser diode chip 41 is a reflector fundamentally, and is not penetrated as a leakage light to the slight quantity of light deer exterior generated with the laser diode chip 41. Therefore, back monitor 42' must presume and carry out the monitor of the quantity of light of leakage light to an actual outgoing radiation light of this slight quantity of light.

フレーム部分及びボスを介して筐体に逃がすことができる。また、上述した実施の形態では、レーザモジュール本体側に凹部を形成し、筐体側に凸部を形成しているが、これらを逆に設けても良いのは勿論であす。すなわち、レーザモジュール本体側に凸部を形成し、筐体側に凹部を形成しても良い。とにかく、レーザモジュールを筐体に対してレーザダイオード発光点を中心に回転可能な構造であれば、どのような構成を採用しても良い。

【００６２】

【発明の効果】以上説明したように、本発明では、フロントモニタを内蔵したので、別途設ける場合に比較して、フロントモニタに流れる電流値のバラツキを少なくすることができ、その結果として、レーザダイオードチップから出射された出射光の光量を正確にモニタすることができる。また、バックモニタを省けるので、低価格化が可能である。

【図面の簡単な説明】

【図１】本発明の一実施の形態に係るレーザモジュールの構成を示す平面図である。

【図２】図１に示したレーザモジュールのII－II線での正断面図である。

【図３】図１に示したレーザモジュールの底面図である。

【図４】図１に示したレーザモジュールの側断面図である。

【図５】本発明に係るレーザモジュールが適用される光ピックアップを示す平面図である。

【図６】図５に示した光ピックアップの光学系を示す構成図である。

【図７】従来のレーザモジュールの構成を示す平面図である。

【図８】図７に示したレーザモジュールの正面図である。

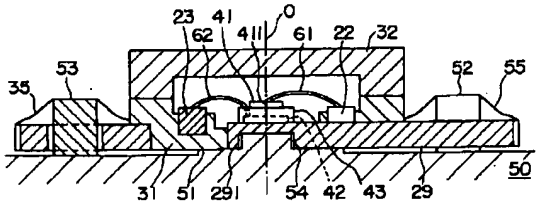
【図９】図７に示したレーザモジュールの底面図である。

【図１０】図７に示したレーザモジュールの側断面図である。

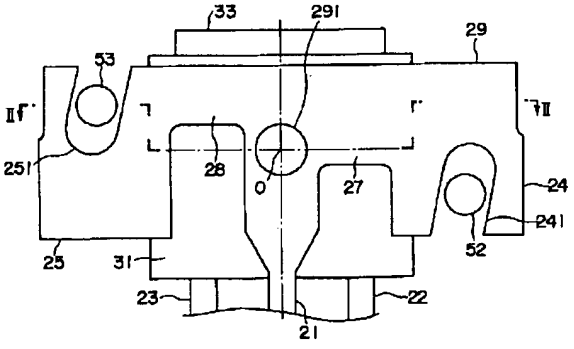
【符号の説明】

２０　リードフレーム
２１　チップ搭載リード端子
２２　レーザダイオードアノード側リード端子
２３　フロントモニタカソード側リード端子
２４　右フレーム支持部
２５　左フレーム支持部
２６　架橋部分
２７，２８　連結部分
２９　リードフレーム部分
２９１　凹部
３０　レーザモジュール本体
３１　下パッケージ
３２　上パッケージ
３３　カバーガラス
４１　レーザダイオードチップ
４１１　発光中心点
４２　フロントモニタ（フォトダイオードチップ）
４３　サブマウント
５０　筐体
５１　台座
５２　右ボス
５３　左ボス
５４　凸部
６１，６２　ワイヤ
７０　偏芯ドライバ
Ｏ　回転軸

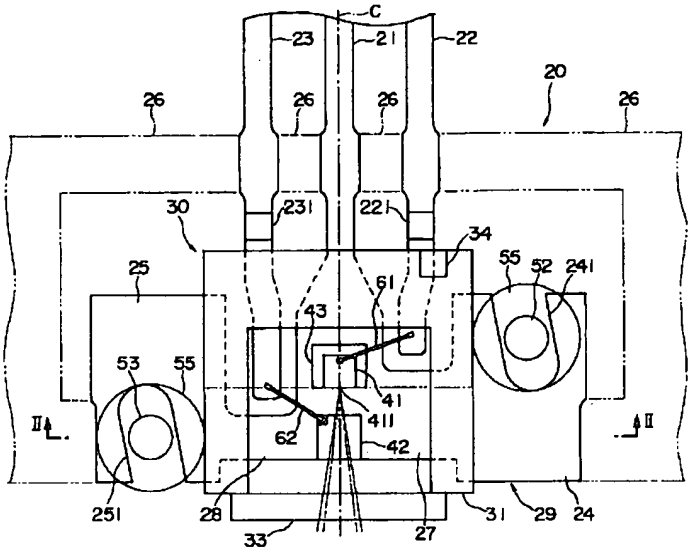
【図２】



【図３】



【図1】


C
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22
20
26
26
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26
30
231
22
34
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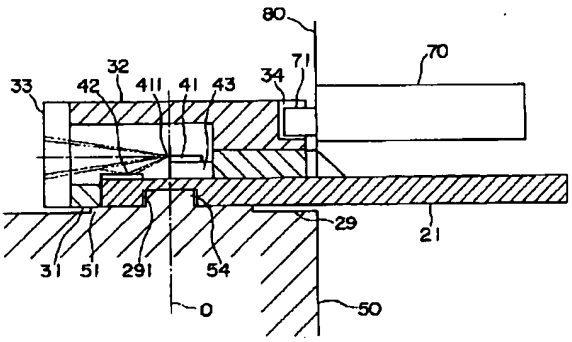
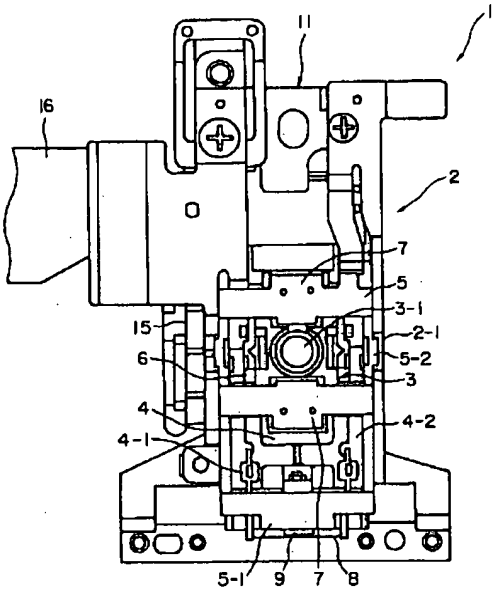
55
52
241
61
43
53
55
41
411
62
42
II
II
251
28
33
27
31
29
24

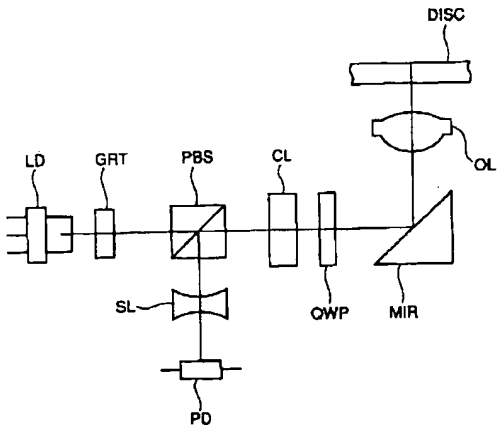
【図4】


80
70
71
32
33
42
411
41
43
34
29
21
31
51
291
54
O
50

【図5】


1
11
16
2
7
5
3-1
15
2-1
6
5-2
3
4
4-2
4-1
5-1
9
7
8

【図6】


DISC
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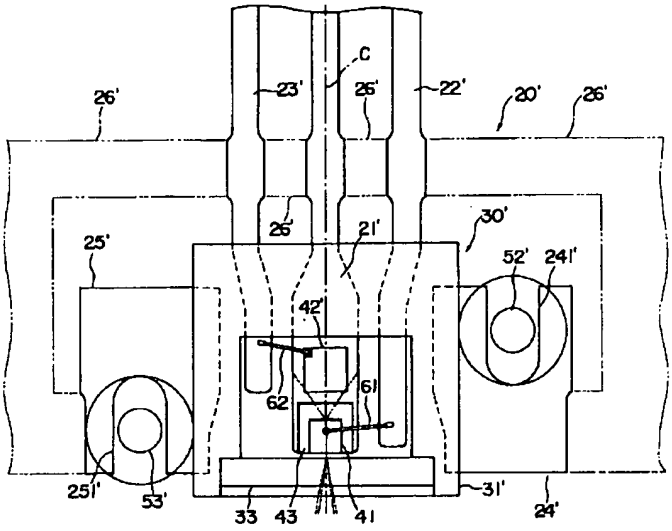
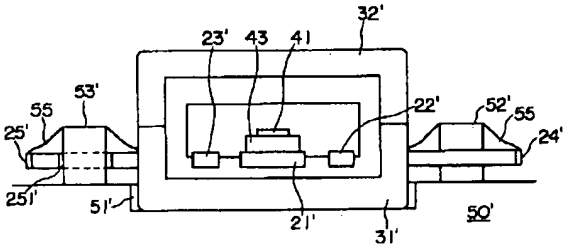
LD
GRT
PBS
CL
SL
QWP
MIR
PD

【図7】


C
23'
25'
22'
20'
26'
26'
26'
25'
21'
30'
52'
241'
42'
62
61
251'
53'
33
43
41
31'
24'

【図8】


32'
23'
43
41
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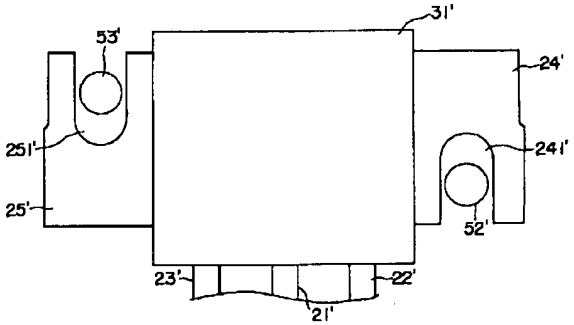
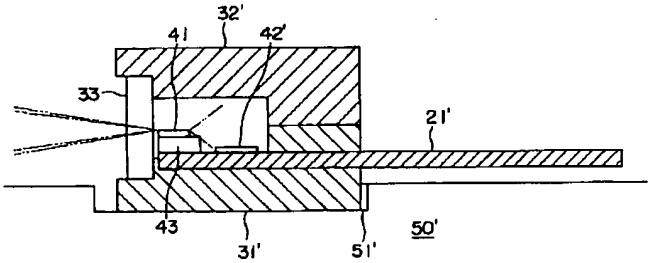
25'
22'
52'
55
24'
251'
51'
21'
31'
50'

【図9】


31'
53'
24'
251'
241'
25'
52'
23'
22'
21'

【図10】


32'
41
42'
33
21'
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31'
51'
50'